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LOCAL ANÆSTHESIA,

BY

DR. RICHARDSON'S METHOD.

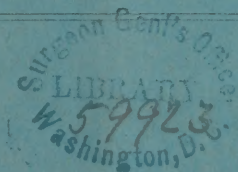
A Clinical Lecture,

By F. DONALDSON, M. D.

Revised by
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Qui Docet Discit.

ART. I.—RICHARDSON'S METHOD OF PRODUCING LOCAL ANÆSTHESIA.

A Clinical Lecture Delivered at the University Hospital, by F. DONALDSON, M. D., Professor of Physiology, Hygiene and General Pathology, in the University of Maryland, Baltimore. (Reported by Dr. R. H. KEALHOFFER, Clinical Reporter, May 5, 1866.)

Now, gentlemen, that we have had the gratification not only of showing you Dr. Richardson's instrument for producing local anæsthesia, but have demonstrated to you, in several operations, its value, we propose making you familiar with it, by calling your particular attention to its history, its manner of operation, and its peculiar advantages. It may be well to state that Dr. Richardson was previously known very favorably to the Profession, by his monograph on the cause of the coagulation of the blood, his essay upon Uræmic Coam, and his article, perfectly exhaustive, on the History of Scarlet Fever. His most valuable contributions to Medical literature, probably, were his paper on the Sub-Clavian Murmur and his volume on the Hygienic Treatment of Tubercular Consumption. This last especially showed him to be, not only a man of science, but a practitioner of rare medical acumen, controlled by excellent common sense. This invention now before us, as simple as it appears to us, he has arrived at, after years of thought and study. We confidently believe it is a production of his genius which must rank him among the benefactors of the human race. We have already the testimony of many observers as to the value of his discovery, and it

affords us pleasure to speak of the satisfactory results of our own use of his instrument. We have repeatedly used it in opening carbuncles, abscesses, extracting teeth, &c.; indeed, every day or two we employ it, and render painless, operations which would otherwise cause acute suffering. Yesterday, we made an incision two inches long by half an inch deep on the back of a child, six months old, and the little creature never moved a muscle nor uttered a cry, for it felt no pain whatever. It did more than annul the pain, it prevented hæmorrhage. A few minutes after the operation, when we sponged off the pus and blood, it cried from the soreness. The child's pulse was not altered, and it received no shock of any kind to its nervous system. Most Surgeons would have hesitated to have given so young a child inhalations of chloroform. What prostration and nausea it would have produced, lasting perhaps for hours! We bear this testimony to its value with cordiality, because there are some who, on theoretical grounds, and some from insufficient trials with imperfect instruments, already carp at its employment. Certainly Dr. Richardson's reputation in the scientific world should have secured an unprejudiced trial of a discovery, which he claims as so valuable, as to be substituted, with advantage, in many cases, for the inhalation of chloroform. But we must expect this opposition, for all great discoveries have met the same fate. This, like vaccination, auscultation and etherization, must in time, from its intrinsic worth, force its acceptance by the Medical Profession. We all acknowledge that it is well to be cautious, not to adopt hastily any new discovery in Medicine; yet, if we wish to keep pace with the advance in our progressive science, we must be ready to investigate fairly whatever claims to be able to promote our usefulness.

Many, even now, still question the value of our daily pocket companion, the hypodermic syringe, with its almost magical power of relieving intense agony. When etherization was proposed it met with violent opposition, and was rejected by those who, it was thought, would gladly have taken it up. Now its great value is everywhere recognized.

As important as was the discovery of producing anæsthesia by inhalation, and as great a boon to the human race as it is acknowledged to be, yet soon after its employment, the fact was recognized that it was not universally applicable. Fatal cases, either from an impure article, or from careless or ignorant administration, or from idiosyncrasy of the individual, caused men to hesitate in its use.

Comparatively few of these fatal cases appeared, yet if you look over the files of medical Journals, you will be surprised at the number of them in the aggregate. They ought to deter us from resorting to its use, except in grave and serious operations. We all daily meet with trivial operations, where we are obliged to cause acute suffering from the knife, because we are unwilling to resort to inhalations of chloroform. We speak of chloroform as a representative of anæsthetics, and of course include ether, nitrous oxide gas, chloric ether, &c.

If we recur to the profound effects of these agents upon the organism, we are surprised that more accidents have not resulted. Chloroform, which is the least soluble, takes one or two hours for its elimination by the lungs. Sulphuric ether, which is more soluble in the serum of the blood, can be detected many hours afterwards, as it is being eliminated by the lungs and kidneys. During all this time, these agents act, to a greater or less degree, injuriously upon the tissues and organs of the body, and impair their functions. We know now from the researches of Snow, Sansom, Anstie, Perrin and Hammond, that when taken internally through the lungs, they have a powerful effect by destroying the equilibrium and correlation of the several functions of the nervous system, and thus, while they apparently stimulate, they in reality paralyze them. Their influence commences with the nerves of the periphery, and spreads inwards to the nervous centres, sensation and voluntary motion being always affected first. We are all familiar with the fact, how early the brain becomes under its influence, as shown by the derangement of the balance of intellectual functions, and of the nerves proceeding directly from the brain, the *motores oculi*, &c. Next in order, we have the spinal cord affected—paralyzed in its successive sections from behind forwards—from below upwards in the human subject. If chloroform and its congeners stopped here, in their paralyzing influences, we could all use it without much risk for the most trivial operation; but I need scarcely remind you, gentlemen, who almost daily witness in this Hospital its effects, that such is not the case, but that carried a step farther, it influences powerfully the *medulla oblongata* and the sympathetic system. When you get your patient under the power of anæsthetic fluids, in their later stages of narcotism, you will notice their paralyzing effect over the *nervi hypoglossi*, which preside over the movements of the tongue, in the thick and confused articulation. Next will be noticed the still more serious disturbance of

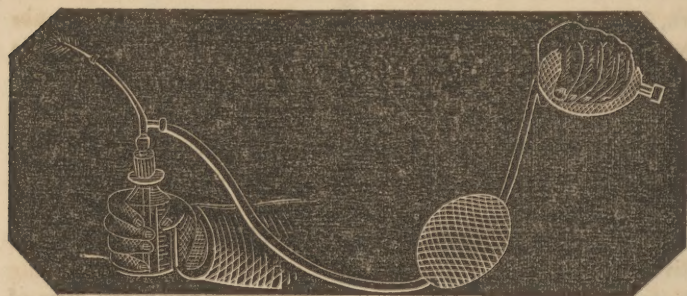
the medulla oblongata, as seen in the hurried, irregular and abnormally depressed respiration, dysphagia, &c. How near this brings your patient to death by apnœa! Unfortunately patients have thus died under the anæsthetic influence, as they have also from the still further disturbance of the economy, by its action on the great sympathetic, presiding as it does over the organic functions, especially the cardiac sympathetic, and causing death by cardiac palsy. There is but one step from the suppression of the animal functions to that of the organic.

This being the case, is it not wonderful that chloroform has not had more fatal results? Dr. Snow has established the fact, that these narcotics produce anæsthesia, by the process of arresting oxidation. Dr. Beale has declared that oxidation of the tissues, &c., was not formative, but destructive, and only affecting structures already living. Dr. Richardson shows that arrest of oxidation means consequently arrest of motion, and that, in fact, anæsthesia amounts to the temporary death of the part influenced, that is, inertia of its molecules. How desirable then is it to substitute, whenever it can be effected, some agent which will annul the sensibility of a portion of the body to be operated upon, without touching the functions of the medulla oblongata and the great sympathetic, and thus endangering life. The first step in this direction was Dr. Arnott's use of extreme cold, by means of ice and salt, applied in a bag. As far back as 1849, we saw Valpeau extract toe nails by its use. We have repeatedly used it, and seen others use it, but with very incomplete success and many failures. It is a bungling and very slow operation at best, even when successful, and gives for these causes great pain, if not as much as the use of the knife. Patients actually prefer the incision to be made without its use. The fact that Arnott's suggestions date back nearly thirty years, and are now but rarely acted upon, shows how effective they have proved. M. Demarquay, a distinguished French Surgeon, came very near making the discovery. He had performed many painful operations by letting fall ether, drop by drop, upon the surface he desired to render insensible, and then induced a rapid evaporation by a current of air. M. Désormaux came nearer still, for he states that he has actually used for ten years a bellows invented by Charrière, throwing air and ether on a part at once, with more or less success. Dr. Richardson, as far back as February, 1859, published his efforts to produce local anæsthesia by Voltaic narcotism. His

idea was, that by quickening the circulation of a part by galvanic stimulus, and immediately applying over the part where the circulation was quickened, a narcotic solution which the blood could absorb, he could so charge the blood locally with the narcotic substance, as to produce anæsthesia. He succeeded, he said, in feeble subjects temporarily, but that in the stronger subjects he failed, because the absorbed narcotic floated into the general circulation; but he now acknowledges that he committed the paradox of applying a form of motion for the indirect production of inertia. His next step was to apply, by the hypodermic plan, narcotic solutions, after having previously used Arnott's ice and salt, but this too was abortive.

The toy used for the diffusing of eau de cologne in the form of spray, suggested, to his inventive genius, its use for the purpose of producing local anæsthesia. This he adapted to Seigle's apparatus, with Dr. Andrew Clarke's hand-ball spray-producer, and tried experiments as to the vaporization of all the known volatile liquids, and he thus advanced to a very important result, namely, that the intensity of the cold produced held a definite relationship to the boiling point, the greater was the amount of cold exhibited. He employed a very delicate thermometer, and by the use of rectified sulphuric ether, he brought down the thermometer within 10° Fah. of zero, and applying it to the skin, produced a marked degree of insensibility, but not sufficient for surgical purposes. Afterwards, by using the spray apparatus in a cylinder containing ice and salt, he brought the thermometer down to 6° Fah. below zero, and applied it to the extraction of teeth with success. But the tube became blocked up, by the condensation of water derived from the air in the air-tube, and the fine jet was closed by the ice formed. He finally abandoned the idea of using salt and ice. It occurred to him that if a larger amount of ether could be brought through the same orifice by mechanical force, in the same interval of time, and with the same amount of air, that he could effect his object—a proportionate increase of cold. As he states, it was a theory of pure physics, admitting of arithmetic demonstration, and running parallel with the ascertained fact, that the cold produced by liquids bears a definite relationship to the boiling point of the fluid used. His theory proved correct to the letter, for by forcing over the ether under atmospheric pressure, instead of trusting simply to capillary action or to motion, the spray evolved brought the thermometer within thirty seconds of

four degrees below zero. I here show you the apparatus as invented and used by Dr. Richardson. When we first read Dr. Richardson's



article in the February number of the *London Medical Times and Gazette*, we seized upon it with avidity, as supplying a want we had long felt. We endeavored to have one constructed in this city, but unsuccessfully. This is an imitation made by Tieman & Co., of New York, but the spray is too large, and although it is imperfect, it does act with astonishing rapidity. The English instrument we ordered from London, but by some mistake it has not reached here yet. You find, on examining the instrument, that it is very simple; the bottle containing the fluid has a cork which is perforated to insert a tube which goes near the bottom of the fluid, and around this is another tube ending immediately below the cork, and extending out to the extremity. This is perforated just above the cork, by a tube connecting with the hand bellows, with an intervening receiver which makes the stream of vapour continuous. The inner tube for the ether goes nearly to the extremity of the larger one. You will perceive that when the bellows are compressed, a double current of air is produced, one current descending and pressing upon the ether, forcing it along the inner tube, and the other ascending through the outer tube, and playing upon the columns of ether as it escapes through the fine jet.

Dr. Richardson did not exaggerate, when he announced that, by this simple apparatus, at any temperature of the day and at any season, we had in our hands means for producing cold even 6° below zero, and by directing the spray upon a half-inch test tube containing water, we can in two minutes produce a column of ice. Further, by the use of a spray catheter, we can send this anæsthetic influence into the bladder, and, by one adapted for the uterus, into the uterus. It

produces no irritation, and may be used to a deep wound. The sensation is immediately one of intense cold, and within a minute, ordinarily, perfect loss of sensibility.

In his first communication, in February last, he mentions a number of cases where it had been used with success; one case where he had narcotised the parts to the depth of two and a half inches, producing complete insensibility, showing that it was not simply superficial anæsthesia which he effected. It has been now used, over and over again, for minor operations, such as opening abscesses, tooth extractions, tying piles, incising carbuncles, &c. We have used it repeatedly, as we before stated, in private practice, for opening abscesses, carbuncles, &c., and have made an incision two or three inches long and half inch deep in a child six months old, without its wincing, and that too in thirty seconds!

You have seen it employed here for phymosis, for amputation of toes, where the incision through the integument was painless. With the spray apparatus, as made in Boston, where you have simply the suction movement, the result is, as we have tried it, uncertain. On one occasion we administered it at a Dentist's with unpleasant effects. It was for the removal of teeth in the upper jaw; but the Dentist had used cotton with which to fill the mouth, to prevent the inhalation of the vapor of ether, but it did not absorb it, and the patient inhaled the vapor, and swallowing the ether, was thus made sick by it. After this we got Messrs. Jennings & Co. to import the fluid known as Rhigolene, which is a naphtha derived from that recently discovered compound petroleum, which has already been, by the ingenuity of man, turned into such useful channels. This fluid was proposed by Dr. Bigelow, of Boston. It is highly inflammable, and is the lightest of known liquids, having a specific gravity of only 0.625, and boils at 70°, having in this way a great advantage over ether, the purest of which boils at about 90°, and the ordinary ether met with at 96°. We have repeatedly used it in the mouth while Dentists removed teeth, and we find no unpleasant results. The slight burning sensation and the unpleasant taste is exceedingly evanescent, the fluid being very volatile. As I hold it in my hands you perceive how it boils, yet to the hand there is no sensation of heat, which seems curious, because we associate boiling with 212°. The vapor condenses so rapidly that there is no danger; at least we carry it about in our pockets when the temperature of the atmosphere is upwards of 80°. We feel confident that Dr. Richardson will adopt the Rhigolene, for

in his very first promulgation of his discovery he speaks of how desirable it would be to have a fluid of the hydro-carbon series, with a boiling point of 75° or 80° ; moreover all the ordinary ethers contain alcohol, which interferes with the success of the operation, and prevent perfect anæsthesia, besides producing a burning and tingling during reaction. You noticed, all of you, no doubt, the whitening influence of the anæsthetic and the coagulation of the vapor, or the formation of ice. Before using the knife you can test, with a needle, the absence of sensibility. The patients sometimes say they feel the touch, but not the pain of the incision. The reaction is in no degree painful, and what is of the utmost importance, the hæmorrhage is controlled. Dr. Richardson explains the *modus operandi* of this process, by stating that it acts at first merely by extracting force, and afterwards, when the nervous filaments are exposed, by presenting the conveyance of force through them—sensation meaning the conveyance of force or motion from the extreme parts to the brain—so that when we administer chloroform by inhalation, we stop the evolution of force by arresting oxidation of blood, and when we employ this instrument we rob, by cold, the local part of the force which has been brought to it by the blood. In addition to cold, Dr. Richardson thinks the substance used controls, by compression and by narcotising, the conducting power of nerve matter.

Dr. Sansom, of London, who reports a number of successful operations, states that he is convinced that the anæsthesia produced by the spray is due simply to the low temperature caused by the rapid vaporization, and that the very fact of the production of cold, the consequent contraction of the blood vessels, and the paralysis of all the nerves, render impossible any absorption of the anæsthetic.

But it is asked, is it not a serious thing to suspend vitality to produce temporary death? Not only from theory do we reply in the negative, but from facts. The rapid abstraction of heat force cannot be at the moment supplied by the 98° of the blood, so that it congeals, insensibility is produced, but the force of the general circulation is not impaired, and almost instantly on the removal of the external reducing agent, the torrent of blood rushes in and restores the vitality. Of course, if kept up too long, as in frost bites, you would have not merely suspension, but destruction of vitality. But as Richardson observes, with acuteness, when we cause general anæsthesia, we produce an approach to temporary death of the whole organism!

We have heard of a case in a neighboring city, where a Surgeon, by this mode, actually froze the contents of a hydrocele, which he certainly must have done without reflecting, that, of course, being a fluid not vitalised, but outside of the influence of reaction by currents of blood, it would remain congealed long enough to produce trouble, and so it did—it actually was followed by sloughing of the scrotum.

We do not pretend that Dr. Richardson's discovery can be used in all capital operations, but we do maintain that with it we can produce complete insensibility of the integument, and for one and a half to two inches deep, and that it can be used with success in amputation and other operations, where the incision through the integument is the principal pain inflicted. Dr. Richardson speaks of deadening the sensibility of the mucous membrane of his own eye; but we should fear it was dangerous to be used about the eye, for fear of freezing the humours, which might be followed by disorganization.

The question of the applicability of this mode of producing insensibility in capital operations, is not merely theoretical. I hold in my hand the *London Medical Times and Gazette* for April, just received, in which we have the details of its perfectly successful use in a case of Cæsarian section, by Dr. Greenhalgh, and again in two cases of ovariectomy by Drs. Braddon and Spencer Wells? What now will the objectors say? The Cæsarean section is not only a capital operation, but perhaps the greatest operation in Surgery. The report of the case is so interesting that I must read portions of it to you:

“Previous to the operation, the body of the patient was laid in a semi-recumbent posture, her head being firmly supported with pillows. Dr. Greenhalgh having indicated the line of his proposed incision from the umbilicus towards the pubis, I commenced to narcotise locally in the centre of the space, making the ether-tubes bend a little towards each other, and directing the brush of spray about one inch and a half from the skin. In a few minutes I found that the ether was telling on a space full four inches long and two broad. I therefore widened the spray by bringing the spray tubes parallel, and I made a gentle movement upwards and downwards, treating the spray as if it was a brush. The whitening of the skin was perceptible at the twenty-fifth stroke of the bellows; at *forty-five seconds the insensibility was perfect*, and Dr. G. made his incision down upon the uterus, dividing the skin and deep layer of fat with one sweep. I moved the spray in company with his knife, and the uterus was made bare. *During this time patient remained absolutely unconscious of*

the incision ; she neither winced nor spoke ; her countenance was perfectly placid, and her pulse, which was being observed by Dr. Wilson, of Glasgow, underwent no variation. A breath of ether spray was directed upon the uterus, but according to our preconcerted plan, the ether was now withdrawn from the open wound, and was directed on the skin surface, which had not been divided on the right side, below the level of the umbilicus. The uterus was thus prompted to contract readily. Having made also painless his incision into the uterus, Dr. Greenhalgh began to introduce his hand, but was somewhat impeded by the uterine contractions. At this point the patient first showed signs of uneasiness, and she asked, 'What is he doing?' He took hold of the child's feet and the uterine contractions expelled the child. The uterus contracted at once so freely, that Dr. McClin-tock, of Dublin, agreed with Dr. Greenhalgh not to use sutures in the uterus. We waited twenty minutes for fear of hæmorrhage, but there was none. During this time she conversed as calmly as possible. In inserting the sutures into the skin, I narcotised for Dr. G. with a small single jet, point by point for each needle, and she felt no pain."

Is not that a complete success? The wound healed with the first intention, and there was no inflammatory indication. The appetite and sleep remained good, and general health was unimpaired. Was not this a triumph, gentlemen, for Dr. Richardson? And was it not far preferable to inducing general anæsthesia, for the operation was as painless.

It is stated that the patient was nauseated previous to the application of the ether. Would she not have vomited from the effects of inhalation? This result would have produced an unpleasant complication, for it might have forced the intestines into the wound. The tendency of this local influence was to check vomiting, and it did actually control hæmorrhage, for she lost only three ounces of blood. The uterine contractions were promoted by the cold. You will have noticed, in the report, that there was not the least shock to the nervous system, nor was there any evidence of cardiac embarrassment. Was not the consciousness of the patient a decided advantage to the operator? She was not in the least restless, and never even moved her body. Who could have guaranteed that her condition would have been as favorable if she had inhaled the vapour, instead of having it applied externally? Bear in mind, gentlemen, that she might

have died from general anæsthesia, a result which was impossible under its local application.*

The details of the two cases of ovariectomy are scarcely less interesting. In both cases the incision through the abdominal walls was rendered perfectly painless.

The operation for strangulated hernia has been successfully performed, under its influence, by Dr. Thorburn.

Who can deny that these cases mark a distinctly progressive step in Medical Science, which can be turned to great advantage in the practice of the Art? Are we premature in predicting for the instrument universal acceptance, as a means for alleviating the horrors of Surgery? It has already proven itself valuable in the treatment of hemorrhage and intense neuralgia. Dr. Richardson proposes to use other remedies, for local influences, mixed with the ethers. He will shortly publish a "Manual for Local Anæsthesia."

We commend the subject to your thoughtful consideration, and feel that our time has not been wasted, if we have assisted you in your mission of usefulness, even to the extent of relieving one human pang.†

*Since the delivery of this lecture, the Cæsarean section has been twice performed with complete success, under the influence of this local anæsthesia, as have also numberless operations of greater or less magnitude. In the last case of Cæsarean section the whole operation, including the incision, the delivery of a living child, and the closing of the wound, was completed in the short space of three and a half minutes.

†At a meeting of the most prominent physicians and surgeons of London, presided over by Mr. Paget, Dr. Richardson's discovery has been acknowledged to be a most brilliant one, and a fund raised as a testimonial of their high estimate of his services.

